

## **APPENDIX D**

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### **PESTICIDES AND HERBICIDES RECOMMENDED AS TARGET ANALYTES**

**Table D-1. Pesticides and Herbicides Recommended as Target Analytes**

Pesticide	Family	Use	Registration	Toxicity class <sup>a</sup>	EPA carcinogenicity classification <sup>b</sup>
<b>Metal Containing Pesticides</b>					
Arsenicals (including arsenic acid, arsenic trioxide, copper acetoarsenite, lead arsenate, calcium arsenate, sodium arsenite)	Inorganic arsenicals	A variety of inorganic arsenic compounds are used as herbicides, fungicides, insecticides and rodenticides, but registered uses of some were superseded because of their hazard to man and other nontarget species ( <i>Farm Chemicals Handbook</i> , 1989)	Some inorganic arsenic compound registrations have been canceled; others are under restricted use application and others are in special review (U.S. EPA, 1993)	I	A <sup>f</sup>
Tributyltins	Organotins	A variety of organotin compounds are used as wood preservatives, antifoulants, biocides, and disinfectants ( <i>Farm Chemicals Handbook</i> , 1989)	Some organotin compounds have been actively registered since the mid-1960s. Several registrations have been canceled or manufacturers discontinued production (U.S. EPA, 1988a)	I	NA <sup>f</sup>

See notes and references at end of table.

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**Table D-1 (continued)**

Pesticide	Family	Use	Registration	Toxicity class <sup>a</sup>	EPA carcinogenicity classification <sup>b</sup>
<b>Organochlorines</b>					
Chlordane	Chlorinated cyclodiene	Termite control. Historically used for control of fire ants, cutworms, grasshoppers, and on other insects on corn, grapes, strawberries, and other crops and as a dip for nonfood roots and tips of plants (Hartley and Kidd, 1987).	In March 1978, the EPA issued a cancellation proceeding on chlordane, allowing only limited use on certain crops and pests until July 1983, but no use thereafter except for underground termite control (43 FR 12372). All uses except subsurface ground insertion for termite control were canceled November 30, 1987. All chlordane/heptachlor products were voluntarily canceled by the registrant, Velsicol. All other chlordane/heptachlor products are either voluntarily canceled or suspended for failure to meet EPA data requirements. The only commercial use of chlordane/heptachlor products still permitted is for fire ant control in power transformers (U.S. EPA, 1990). The sale, distribution, and shipment of existing stocks of all canceled chlordane/heptachlor products is prohibited in the U.S. as of April 15, 1988. The use of existing stocks of termiticide products in the possession of homeowners is also permitted (53 FR 11798; 54 FR 20194).	II	B2

See notes and references at end of table.

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**Table D-1 (continued)**

Pesticide	Family	Use	Registration	Toxicity class <sup>a</sup>	EPA carcinogenicity classification <sup>b</sup>
DDT	Chlorinated hydrocarbon	Insecticide	All uses in U.S. were canceled as of January 1, 1973, except for emergency public health uses. Effective December 31, 1988, all uses were canceled unless registered formulas contain less than 0.1% DDT (51 FR 19508).	III	B2
Dicofol	Chlorinated hydrocarbon	Acaricide on many fruit, vegetable, ornamental and field crops. Historically used to control mites on cotton and citrus (60%). Other major uses included control of mites on apples (10%), ornamental plants and turf (10%) and 20% on a variety of other agricultural products (pears, apricots and cherries), seed crop soil treatment, vegetables, (e.g., beans and corn) and shade trees (51 FR 19515) (U.S. EPA, 1986b).	Active since 1957; however all uses are to be canceled after January 1989 unless registered formulas contain less than 0.1% DDT and related contaminants (51 FR 19508). <sup>c</sup>	III	C <sup>d</sup>

See notes and references at end of table.

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**Table D-1 (continued)**

Pesticide	Family	Use	Registration	Toxicity class <sup>a</sup>	EPA carcinogenicity classification <sup>b</sup>
Dieldrin	Chlorinated cyclodiene	Control of locusts, tropical disease carriers (e.g., mosquitoes), and termites, use as wood preservative, and moth proofing for woolen clothes and carpets (Worthing, 1991).	All uses on food products were suspended in 1974 (ATSDR, 1987a). All uses in the U.S. were banned in 1985 except for subsurface termite control, dipping of nonfood roots and tops, and moth proofing in a closed system (U.S. EPA, 1985b). These uses have been voluntarily canceled by industry (ATSDR, 1987a).	II	B2
Endosulfan (I and II)	Chlorinated bicyclid sulfite	Insecticide and acaricide on citrus, deciduous, small fruits, coffee, tea, fiber crops, forage crops, forest, grains, nuts, oil crops, tobacco, ornamentals, and vegetables.	Active since 1954. Used for control of aphids, thrips, beetles, foliar feeding larvae, mites, borers, cutworms, bollworms, bugs, whiteflies, leafhoppers and slugs on citrus, deciduous, small fruits, coffee, tea, fiber crops, forage crops, forest, grains, nuts, oil crops, ornamentals, tobacco, and vegetables. <sup>c</sup>	I	E <sup>d</sup>

See notes and references at end of table.

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**Table D-1 (continued)**

Pesticide	Family	Use	Registration	Toxicity class <sup>a</sup>	EPA carcinogenicity classification <sup>b</sup>
Endrin	Chlorinated cyclodiene	Historically used to control cotton bollworms, as a foliar treatment for citrus, potatoes, small grains, apple orchards, sugarcane, and as flower and bark treatment on trees. Endrin has also been used to control populations of birds and rodents (U.S. EPA, 1980).	In 1964, endrin persistence in soils led to cancellation of its use on tobacco (U.S. EPA, 1980). By 1979, specified uses on cotton, small grains, apple orchards, sugarcane and ornamentals were also restricted (44 FR 43632). In 1984, the sole producer of endrin voluntarily requested cancellation of all endrin products (U.S. EPA, 1984a).	I	D
Heptachlor epoxide	Chlorinated cyclodiene	Heptachlor epoxide is an oxidation product of heptachlor. It is a contaminant of both heptachlor and chlordane. Heptachlor was widely used as a termiticide and insecticide, primarily for ant control (Hodges, 1977).	Termide (chlordane) sales halted per Velsicol and EPA agreement pending results of specific application tests. Restrictions on heptachlor were first instituted in 1978 and heptachlor can no longer be sold in the U.S. as of August 1987 but remaining stocks can be used in some States by commercial exterminators for termite control. All uses have been banned in Minnesota, Massachusetts, and New York (ATSDR, 1987b).	NA	B2

See notes and references at end of table.

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**Table D-1 (continued)**

Pesticide	Family	Use	Registration	Toxicity class <sup>a</sup>	EPA carcinogenicity classification <sup>b</sup>
Hexachlorobenzene	Chlorinated benzene	Primary use prior to 1985 was as a fungicide seed protectant in small grain crops, particularly wheat.	Registration of hexachlorobenzene as a pesticide was voluntarily canceled in 1984 (Morris and Cabral, 1986).	IV	B2
Lindane ( $\gamma$ -hexachlorocyclohexane)	Chlorinated hydrocarbon	Seed treatments, soil treatments for tobacco transplants, foliage applications on fruit and nut trees, vegetables, and wood and timber protection.	Use of lindane in smoke fumigation devices for indoor domestic purposes was banned in 1985 (48 FR 48512, 50 FR 5424). Use in dog dips permitted only for veterinary use (U.S. EPA, 1985a). Application permitted only under supervision of certified applicator (U.S. EPA, 1985a).	II	B2/C <sup>d,e</sup>
Mirex	Chlorinated cyclodiene	Historically used primarily in fire ant control in southeastern States (Kutz et al., 1985) and was used industrially as a fire retardant and polymerizing agent in plastics under the name dechlorane.	All registered uses of mirex were canceled in 1977 (41 FR 56703). All existing stocks were not to be sold, distributed, or used after June 30, 1978 (NAS, 1978).	II	R
Toxaphene	Chlorinated camphene	Historically used extensively on cotton ( <i>Farm Chemicals Handbook</i> , 1989). Note: A toxaphene-like compound can be a byproduct of the paper industry and has been identified in the Great Lakes region (J. Hesse, Michigan Department of Public Health, personal communication, 1992).	Registration for all uses was canceled in the U.S. in November 1982 (47 FR 53784; U.S. EPA, 1990).	II	B2

See notes and references at end of table.

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**Table D-1 (continued)**

Pesticide	Family	Use	Registration	Toxicity class <sup>a</sup>	EPA carcinogenicity classification <sup>b</sup>
<b>Organophosphates</b>					
Chlorpyrifos	Heterocyclic organophosphate	Insecticide primarily used to control soil and foliar insect pests on cotton, peanuts, and sorghum (Worthing, 1983; U.S. EPA, 1986a). In addition, it is used to control root-infesting and boring insects on a variety of fruits (e.g., citrus crops, apples, bananas, peaches, grapes, nectarines), nuts (e.g., almonds, walnuts), vegetables (e.g., beans, broccoli, brussel sprouts, cauliflower, soybeans, cabbage, peas) and field crops (e.g., alfalfa and corn) (U.S. EPA, 1984b) and to control ticks on cattle and sheep (Thomson, 1985). As a household insecticide it has been used to control ants, cockroaches, fleas, and mosquitoes (Worthing, 1983) and is registered for use in controlling subsurface termites in California (U.S. EPA, 1983).	Active since 1965 (U.S. EPA, 1984b). <sup>c</sup>	II	D <sup>d</sup>

See notes and references at end of table.

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**Table D-1 (continued)**

<b>Pesticide</b>	<b>Family</b>	<b>Use</b>	<b>Registration</b>	<b>Toxicity class<sup>a</sup></b>	<b>EPA carcinogenicity classification<sup>b</sup></b>
Diazinon	Heterocyclic organophosphate	Insecticide and nematicide for control of soil insects and pests of fruits, vegetables, tobacco, forage, field crops, range, pasture, grasslands and ornamentals. Used to control cockroaches and other household insects; grubs and nematodes in turf; as a seed treatment and for fly control ( <i>Farm Chemicals Handbook</i> , 1989).	Active since 1952 (U.S. EPA, 1986c). <sup>c</sup>	II	D <sup>d</sup>
Disulfoton	Aliphatic organophosphate	Systemic insecticide and a acaricide on grain, nut, cole and root crops; pome, strawberry and pineapple fruits; forage, field and vegetable crops, sugarcane, seed crops, forest plantings, ornamentals and potted plants (houseplants) (U.S. EPA, 1984b).	Active since 1958 (U.S. EPA, 1984c). <sup>c</sup>	I	D <sup>d</sup>
Ethion	Organothiophosphate	Insecticide (nonsystemic) for control of leaf-feeding insects, mites, and scale insects. Citrus accounts for 86%-89% of total pounds of ethion used in the U.S. with the remaining 11%-14% applied to cotton, a variety of fruit trees, nut trees, and vegetables (U.S. EPA, 1989).	Active since 1965 (U.S. EPA, 1989). <sup>c</sup>	II	D <sup>d</sup>

See notes and references at end of table.

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**Table D-1 (continued)**

Pesticide	Family	Use	Registration	Toxicity class <sup>a</sup>	EPA carcinogenicity classification <sup>b</sup>
Terbufos	Organophosphate	Systemic insecticide and nematocide on corn, sugar beets, and grain sorghum (U.S. EPA, 1985c).	Active since 1974; however, granular end-use products containing 15% or more terbufos were classified as "Restricted Use" after September 1985 (U.S. EPA, 1985c). <sup>c</sup>	I	D <sup>d</sup>
<b>Chlorophenoxy Herbicides</b>					
Oxyfluorfen	Diphenyl ether	Pre- and postemergence herbicide for a wide spectrum of annual broadleaf weeds and grasses in apples, artichokes, corn, cotton, tree fruit, grapes, nuts, spearmint, peppermint, certain topical plantation, and ornamental crops ( <i>Farm Chemicals Handbook</i> , 1989)	Active since 1979. <sup>c</sup>	II	C <sup>d</sup>

<sup>a</sup> Designations are from *Farm Chemicals Handbook* (1989):  
 I = Oral LD<sub>50</sub> up to and including 50 mg/kg in laboratory animals.  
 II = Oral LD<sub>50</sub> from 50 through 500 mg/kg in laboratory animals.  
 III = Oral LD<sub>50</sub> from 500 through 5,000 mg/kg in laboratory animals.  
 IV = Oral LD<sub>50</sub> greater than 5,000 mg/kg in laboratory animals.  
 NA = No value available.

<sup>b</sup> Designations are from IRIS (1992) unless otherwise noted: NA = not evaluated; A = human carcinogen; B1, B2 = probable human carcinogen; C = possible human carcinogen; D = inadequate evidence of animal carcinogenicity; E = no evidence of carcinogenicity for humans; R = under review by EPA.

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<sup>c</sup> This pesticide has an active registration for agricultural use. The EPA Office of Pesticide Programs is responsible for registration and reregistration of pesticides. The 1988 Amendment of FIFRA requires EPA to reregister each "registered pesticide containing any active ingredient contained in any pesticide first registered before November 1, 1984, except for any pesticide as to which the Administration has determined, after November 1, 1984 . . . that—(1) there are no outstanding data requirements; and (2) the requirements of section 3(c)(5) have been satisfied" (U.S. EPA, 1988). The Agency will review all relevant data submitted by the registrant for each pesticide reregistration and will use the data to conduct a risk assessment. Any subsequent regulatory action will be based on the results of the risk assessment. If the data submitted are incomplete at the predetermined review time, the pesticide may be suspended.

<sup>d</sup> EPA carcinogenicity classification based on Classification List of Chemicals Evaluated for Carcinogenicity Potential (U.S. EPA, 1992).

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